# **Proceedings**

from the

# NASA Health Physics Conference

October 2-5, 2000 Annapolis, Maryland

**December 20, 2000** 

NASA Occupational Health Program
Principal Center Office
John F. Kennedy Space Center

# Proceedings

from the

# NASA Health Physics Conference

# Prepared for

The National Aeronautics and Space Administration Occupational Health Program Principal Center Office John F. Kennedy Space Center, Florida

*by* 

The Bionetics Corporation Mail Code BIO-5 Kennedy Space Center, Florida 32899

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# Contents

Introduction	1
NASA Center Presentations	1
Tad Blanchard, Goddard Space Flight Center	2
Arnold (Jack) Orsak, Johnson Space Center	5
Rick Vogel, Langley Research Center	6
AnnaMaria Pal, Glenn Research Center	8
Randall (Randy) Scott, Kennedy Space Center	15
Health Physics Operations During the Cassini Launch	25
Radiation, Laser and Electromagnetic Energy Safety	25
Outdoor Laser Usage	25
Tour of Goddard Space Flight Center	25
Radiation Training	26
Conclusion	26
Participants	27
Appendix	29

# **Proceedings from the NASA Health Physics Conference**

#### Introduction

On October 2-5, 2000 the NASA Occupational Health Program sponsored a conference for the Agency's Health Physics professionals at the Radisson Hotel in Annapolis, Maryland. The conference participants included individuals from NASA Centers who are responsible for Health Physics and Radiation Safety. The purpose of the conference was to give Health Physics professionals an opportunity to share programs, review new issues and requirements, discuss situations that occur at the Centers and how they are handled, and to network with their peers.

A Welcome and Networking Reception was scheduled at the hotel the night before the conference, and provided an informal environment for participants to say hello to friends, become acquainted with other participants, and initiate Health Physics discussions.

The conference began on Tuesday with a formal welcome from William S. Barry, MD, MPH, Manager, NASA Occupational Health Program Principal Center Office located at the Kennedy Space Center.

#### **NASA Center Presentations**

The Health Physics professionals gave brief overviews of their programs and explained how they operate. All presentations were well received and expanded the knowledge of the participants on the work that is required and the unique situations that occur at the various Centers. Mr. Mark Phillips, Radiation Safety Officer at Jet Propulsion Laboratory gave an oral presentation without the use of graphics materials. Mr. David Thaxton, Occupational Health Officer at Marshall Space Flight Center, also gave an oral presentation on Marshall's radiation safety program and state of current radiation safety issues at the Center. The other presentations are included in the Proceedings.

#### **Tad Blanchard**

# Assistant Radiation Protection Officer Goddard Space Flight Center



#### **Goddard Space Flight Center Radiation Protection Program**



Parallax INC.

- NRC Broadscope Byproduct Material License
- NRC Co-60 Irradiator License
- 607 Sources of Ionizing Radiation
- 90 Approved Users of Ionizing Radiation
- 24 Approved Radioactive Source Custodians



#### Goddard Space Flight Center Radiation Protection Program



**GSFC** 

- ~200 Sources of Non-Ionizing Radiation
- ~100 Lasers
- ~300 Approved Users of Lasers
- ~25 Approved Laser Custodians



Goddard Space Flight Center Radiation Protection Program



Parallax INC. Member of the OHI Team

## **Staffing**

- Radiation Safety Committee
- Radiation Safety Officer
- Senior Health Physics Technician
- Health Physics Technician

#### Tad Blanchard

**Assistant Radiation Protection Officer** Goddard Space Flight Center



**Goddard Space Flight Center Radiation Protection Program** 



#### Responsibilities

- Management Shall Ensure that Workers **Follow GSFC:** 
  - **Policy Directive for Radiation Protection (GPD)**
  - **Procedures and Guidelines for Radiation** Protection (GPGs)
  - **Work Instructions for Radiation Protection** (WIs)



**Goddard Space Flight Center Radiation Protection Program** 



**GSFC** 

# Parallax

### Responsibilities

- All Users and Custodians of Radioactive Source Material Must Complete Training and be Approved by the RSC
- F Health Physics Staff Notification and RSC Approval is Required Prior to Any Requisition, Purchase, Transfer, Relocation, Shipment, Receipt, Disposal, Use or Modification of Any Radioactive Source Material at GSFC or WFF



**Goddard Space Flight Center Radiation Protection Program** 



**GSFC** 

#### **Services**

- Personnel and Area Monitoring
- **Radiation Safety Training**
- Source Monitoring, Testing and Inventory
- Radioactive Waste Disposal
- Decontamination
- Radiation Detection Instrument Maintenance, Repair and Calibration

### **Tad Blanchard**

# Assistant Radiation Protection Officer Goddard Space Flight Center



#### **Goddard Space Flight Center Radiation Protection Program**



A Member of the OHI T

#### **Services**

- Launch Request Approvals Involving Radioactive Sources
- X-ray and Accelerator Surveillance
- Maintain NRC Licenses
- Laser System Safety
- Microwave, Radiofrequency, and, Electromagnetic Safety
- Recordkeeping

#### Arnold (Jack) Orsak

Radiation Safety Officer Johnson Space Center



- IONIZING RADIATION
  - X-RAY PRODUCING EQUIPMENT
    - MEDICAL & DENTAL DIAGNOSTIC
    - INDUSTRIAL RADIOGRAPHY
  - NRC TYPE A BROAD SCOPE LICENSE
    - RESEARCH & DEVELOPMENT
    - SEALED SOURCES & FOILS
    - SPECIFIC ISOTOPE HUMAN USE



# JOHNSON SPACE CENTER RADIATION PROTECTION PROGRAM

- NONIONIZING RADIATION
  - LASERS
  - RF TRANSMITTERS & SEALERS
  - SUB-RADIOFREQUENCY MAGNETIC FIELDS
  - UV STERILIZERS



# JOHNSON SPACE CENTER RADIATION PROTECTION PROGRAM

- ASTRONAUT RADIATION DATABASE
  - SPACE MISSION EXPOSURES
  - EXPERIMENT EXPOSURES
  - DIAGNOSTIC EXPOSURES
  - FLIGHT SURGEON REPORT

#### Rick Vogel, CIH, CSP

Industrial Hygienist/Radiation Safety Officer Langley Research Center

# LaRC Radiation Safety Program

Rick Vogel, CIH, CSP NASA LaRC, Office of Safety and Facility Assurance

# **Radiation Safety Permits**

- Ionizing and Non-Ionizing Radiation
   Sources are used under the requirements of
   a Safety Permit which must be renewed
   annually
  - Specialized training for handlers
  - Proper PPE
  - Engineering or Administrative Controls to limit exposure
  - Physical Exam tailored to exposure

# **Ionizing Radiation**

- All sources used under annual Safety Permit issued by the Ionizing Radiation Committee
- Annual Audit of Operations
  - Dosimetry
  - Use Conditions
- Sealed ionizing sources
- X-ray devices

### Rick Vogel, CIH, CSP

# Industrial Hygienist/Radiation Safety Officer Langley Research Center

# Non-Ionizing Radiation

- All Devices Used under Annual Safety Permit issued by the Non-Ionizing Radiation Committee
  - Control Areas with Inter-locked doors
  - Warning Signs
- Microwave/RF Sources
- Lasers (Class 3 and 4)
  - Mandatory Use of Eye Protection at all times
- High Intensity IR/UV/Visible Lights

# Non-Ionizing Radiation

- All Devices Used under Annual Safety Permit issued by the Non-Ionizing Radiation Committee
  - Control Areas with Inter-locked doors
  - Warning Signs
- Microwave/RF Sources
- Lasers (Class 3 and 4)
  - Mandatory Use of Eye Protection at all times
- High Intensity IR/UV/Visible Lights

# **Radiation Safety Program Statistics**

- Non-Ionizing Radiation
  - ->100 Class 3b and Class 4 Lasers
    - Fixed, portable and airborne systems
  - High Energy RF Sources
    - Plasma Drag Experiment
    - 2 Plasma Coating Units
    - EMP Generator
  - 45 Non-Ionizing Radiation Permits
  - 525 Non-Ionizing Radiation Workers
  - 80 Facility Audits Annually

# Health Physicist Glenn Research Center





# Health Physics Program Glenn Research Center

AnnaMaria Pal Health Physicist



# Health Physics Team Mission

 Provides the technical guidance needed to comply with governmental and institutional regulations regarding the use of ionizing and non-ionizing radiation sources, electromagnetic fields, and radio frequency generators.



# Health Physics Program

- Ionizing Radiation
- Non-ionizing Radiation

# Health Physicist Glenn Research Center



# Ionizing Radiation

- Licensed radioactive materials
- Generally licensed materials
- Cyclotron activated materials
- X-ray Units
- Plum Brook Reactor Facility





### Radioactive Materials

- Used primarily to calibrate instruments
  - Americium- 241
  - Americium- Beryllium (~50Ci)
  - Cesium- 137
  - Cobalt- 60
  - Plutonium-239
  - Radium- 226
  - Technetium- 99



# Cyclotron Facility

- 1955 installed by GE
  - Research related to space nuclear propulsion
  - Radiation damage studies
- 1970 shutdown to update
- 1972 terminated nuclear research
- 1975 Cleveland Clinic Foundation
  - Funded by National Cancer Institute

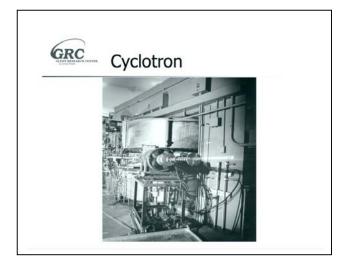
# Health Physicist Glenn Research Center



# Cyclotron Facility

- 1990 CCF terminated FNT
- Currently, radiation levels too high to dismantle
- All areas associated with cyclotron are smeared twice monthly





# Health Physicist Glenn Research Center







# CRC X-ray/ SEM Facilities

- 10 x-ray diffraction units
- 20 SEM, TEM units
- 1 medical x-ray unit

# CRC X-ray/ SEM Facilities

- Operators wear Landauer's Luxel badges
  - Optically Stimulated Luminescence dosimeter
- Minimal dose equivalent reportable
  - X-ray, gamma: 1 mrem
  - Rings: 30 mrem
- Inspected yearly

# Health Physicist Glenn Research Center



# Plum Brook Reactor Facility

- Complex of buildings on 27 acres
- 60 megawatt materials test reactor
- 100 kilowatt swimming pool type mock-up reactor
- Performed irradiation testing of fueled and unfueled experiments for space program



#### **PBRF**

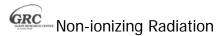
- 1956-1960 construction
- 1963- 1973 operational
- 1973- 1977 "possess but do not operate" mode
- 1979 decision to dismantle
- 1998 NASA commits to decommission by CY 2007



AnnaMaria Pal Health Physicist Glenn Research Center







- Lasers
  - ~450 in use
- Electromagnetic radiation sources
  - communications, induction heaters
- Radio Frequency generators

# Health Physicist Glenn Research Center



# Summary

- Ionizing Radiation program
  - Monitor radiation levels, exposures
  - Facility surveys
- Non-ionizing Radiation program
  - Maintain laser safety standards
  - Survey other facilities as needed

# Randall (Randy) Scott, MS Radiation Protection Officer

Kennedy Space Center



# OUTLINE

- General Policy
- Program Documents
- Ionizing Radiation Sources
- Non Ionizing Radiation Sources
- Use Request & Authorization Process
- Provisions, Guidelines, and Points of Contact
- Radiation Emitter Photos

# GENERAL POLICY

- Centralized Control and Hazard Analysis of Radiation Sources
- Formal and Standardized use Authorization Process
- ALARA Principle (As Low As Reasonably Achievable)
- Applicable to both KSC and CCAFS areas

# Randall (Randy) Scott, MS

Radiation Protection Officer Kennedy Space Center

# PROGRAM DOCUMENTS

- KMI 1860.1C KSC RPP
- KHB 1860.1B Ionizing RPP
- KHB 1860.2A Non Ionizing RPP
- 45 SW Instruction40-201 Radiation Protection Program

# IONIZING SOURCES

Radioactive Material

Flight and Ground Calibration/Check Sources

Radioisotpes in Research

Static Meters/Smoke Detectors

Heater Units/Power Sources

Radiography

Radiation Devices

X-ray Machines (Diagnostic/Industrial)

Accelerators

# NON-IONIZING SOURCES

RF/MW Emitters

Radar

Communications

Telemetry

RF/MW Generators

RF Sealers/Heaters

Laser/Laser Diodes

Alignment

Distance and Ranging

Fiber Optics

Optical Sources

Infra Red

Hi Intensity Visible

Ultra Violet

# Randall (Randy) Scott, MS

## **Radiation Protection Officer** Kennedy Space Center

#### USE REQUEST-AUTHORIZATION PROCESS

User Completes and Submits KSC Forms

Identification & Descriptions

Procedures

Locations

User Qualifications

- Submittal is Evaluated for Hazard Potential and Regulatory Compliance
- Controls and Conditions are Assigned
- RPC Issues approved U/A Package to User

#### PROVISIONS & GUIDELINES

Exemptions

Negligible or no Hazard Exempt from Controls

General Use Authorizations

Minimal Hazard Valid Indefinitely

Hazardous Procedures

Specific Use Authorizations

Moderate to High Hazard

Annual Renewal

Hazardous Procedures

Hazard Evaluation

Theoretical/CALC

Survey/Measurement

Verification & Compliance

### POINTS OF CONTACT

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Randall Scott

TA-C2

321-867-6958 / Fax -2679

45 SW Radiation Protection Officer

Lt. Col. Richard Speer

ADOS/SGGB PAFB, FL

321-494-5435 / Fax -5055

CHS Health Physics Office

Rod Nickell

321-853-5688 / Fax-2887

# Randall (Randy) Scott, MS

# **Radiation Protection Officer** Kennedy Space Center



#### **Radiation Use Authorization**

- I. Applicable personnel protective standards
- II. Authorized sources and approved use/storage locations
- III. Authorized user personnel
  - A. Area Radiation Officer (ARO): Individual designated by the user organization's management as their representative for matters pertaining to the local control of radiation hazards
  - B. Operators of radiation sources/emitters
- IV. Applicable customer operating procedures

#### Radiation Use Authorization (Continued)

- V. Hazard Evaluation
  - A. Operating Parameters and Protection Guide B. Range of Hazard Distance
- VI. Operational Provisions
  - A. Operational Controls and Provisions
    - Radiation Control Areas: Defined areas for the control of personnel exposure.
       Notification Requirements
       Sposting Requirements
       Inventory/Accountability Requirements
       General Operating Provisions
  - B. Administrative Provisions
  - Authorized Period of Use
     RUA Change Request procedures

#### Diagnostic X-Ray Rooms

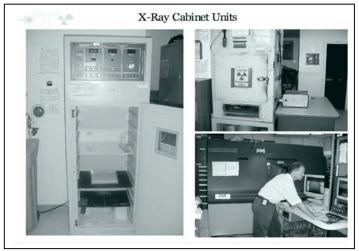


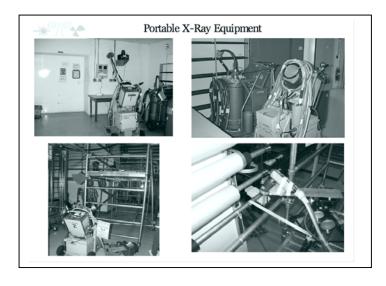


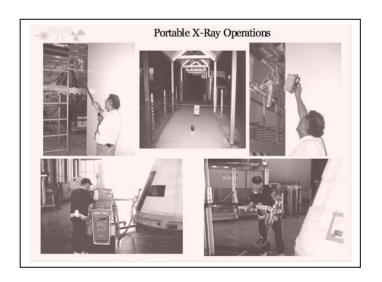


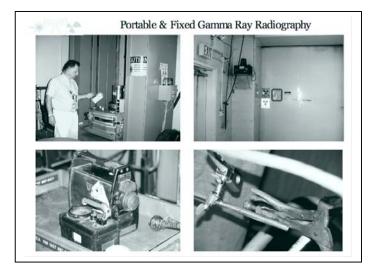




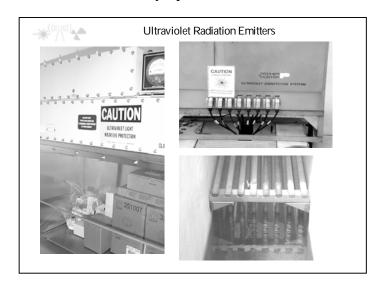


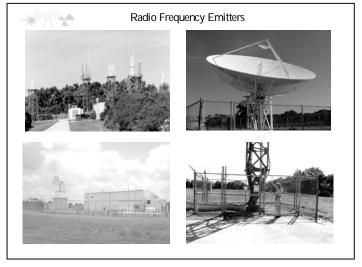


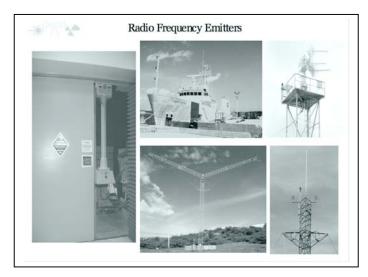


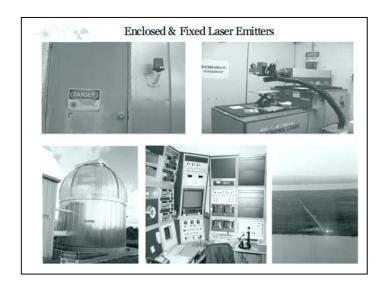


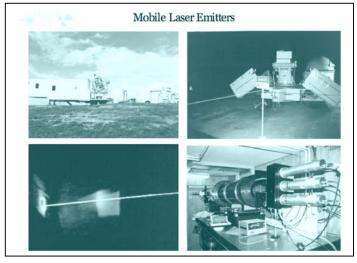


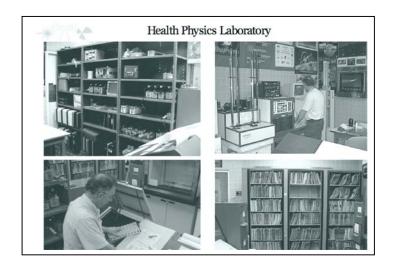


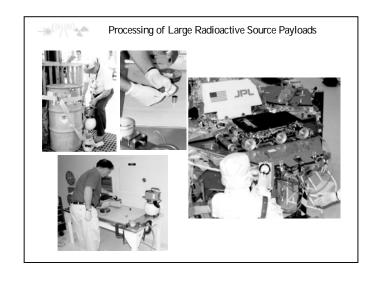


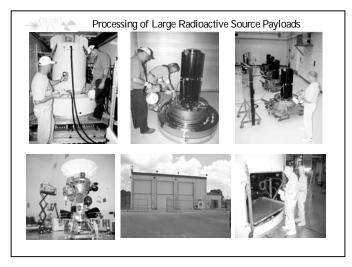






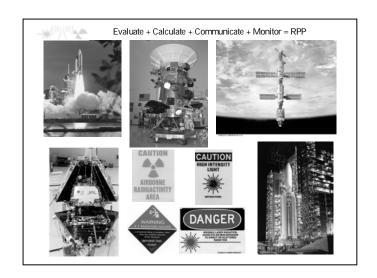












### Health Physics Operations During the Cassini Launch

Randy Scott, Radiation Protection Officer at Kennedy Space Center, provided a detailed presentation on the use of Laser Imaging Systems in support of the Cassini launch. Rod Nickell, Health Physics Program Manager, described the highly coordinated Health Physics operations procedures that were developed and implemented for launch support.

#### **Laser Imaging Systems**

The purpose of the Laser Imaging Systems and why they were required for launch of the Cassini spacecraft were discussed in this presentation. In addition, laser safety measures, which ensured adequate safety, and surveillance measures for ground support personnel preparing for the launch were described. These measures were used to prevent inadvertent exposure to laser emissions.

### **Health Physics Operations**

An overview of the Health Physics preparations, planning, training, and operational support provided to the Cassini mission was presented. The key program requirements for dose reduction, proper monitoring, and operational support were highlighted. Health Physics support was discussed in a chronological format from Radioisotope Thermoelectric Generator arrival and payload processing through launch contingency operations. To document the process and determine its effectiveness, personnel collective dose was compared to previous large source launches.

# Radiation, Laser and Electromagnetic Energy Safety

The Occupational Health Program office provided training videotapes obtained from Rockwell Industries and NARDA. The videotapes were reviewed to encourage Agencywide commonality in Health Physics training. Health Physics personnel selected videotapes that would be most useful at their Centers.

# **Outdoor Laser Usage**

Many of NASA's operations involve the use of outdoor laser systems in populated areas and heavily trafficked air corridors. Mr. Phil Nessler, Environmental Team Leader at Goddard Space Flight Center has been active in both the ANSI and SAE G10T committees as well as serving as point of contact for NASA negotiations with the Federal Aviation Administration. Mr. Nessler reported to the group on the progress of changes to ANSI Standard Z136.6 which is expected to become final this year. He also reported on discussions with the FAA to establish a relationship between agencies which would foster better communication and facilitate more efficient processing of requests.

# **Tour of Goddard Space Flight Center**

On Wednesday the conference attendees were treated to a tour of the Goddard Space Flight Center. The tour included stops at major operations buildings as well as the Radiation Effects Facility. The tour was completed with a visit to the Goddard Geophysical and Astronomical Observatory and an exciting live demonstration of the MOBLAS 7 and TLRS 4 Satellite Laser Ranging Systems. The tour of GSFC provided the attendees with a more detailed glimpse into the mission and operation of the Center and demonstrated the application of their Health Physics program. The demonstration at the Geophysical and Astronomical Observatory provided a live demonstration of the extensive safety precautions necessary to operate an outdoor laser system in the airspace of a heavily traveled urban area.

### **Radiation Training**

Two sessions on radiation training were provided by the US Army Center for Health Promotion and Preventive Medicine (CHPPM), Aberdeen Proving Ground, Maryland. Mr. James Franks gave a training session on laser and optical radiation and Mr. John DeFrank provided training on radio frequency and ultrasound radiation.

This training, presented by recognized experts in the field, provided participants with an update on significant and relevant standards, issues, detection methods and equipment, and management practices. The instructors also provided a CD-ROM to all attendees which contained information provided during the conference as well as additional reference material related to non-ionizing radiation. The Appendix contains a list of topics included on the CD-ROM.

#### Conclusion

The participants as a group expressed appreciation for the effort that had been taken to arrange a conference that was specific to the needs of the NASA Health Physics community. Many attendees voiced the opinion that the exchange of information and networking opportunities saved them significant time and effort on issues that they had been working at their respective Centers. The attendees departed with a strong enthusiasm to continue the lines of communication that had been developed at this conference.

The OHP Principal Center Office was asked to create a health physics discussion board on the OHP Website to encourage continued use of communications links opened at the conference. The Website was completed shortly after the conference and the health physics field has become the most active area on the Website discussion boards.

Please contact Dr. Barry or personnel who work in the Occupational Health Program Support Office if you need additional copies of the Proceedings or have questions regarding Health Physics operations at NASA Centers. In addition, Mr. Guy Camomilli has recently accepted the position of Senior Environmental Health Officer for the Occupational Health Program and can be reached at 321-867-1417 if you have questions about Health Physics programs.

# **Participants**

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#### **APPENDIX**

#### **US Army Center for Health Promotion and Preventive Medicine CD-ROM Topics**

#### Cell Phones

- o Cell Phone Antennas and Human Health
- Food and Drug Administration Frequently Asked Questions (FAQ) on Cell Phones
- o Occupational Exposure of Police Officers to Microwave Radiation
- o Cell Phones and Cancer: What is the Evidence for a Connection?

### • Electromagnetic Fields

- National Institute of Environmental Health Sciences Report on Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields
- A Review of the Potential Health Risks of Radiofrequency Fields from Wireless Telecommunication Devices
- Assessment of Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields
- International Commission on Non-Ionizing Radiation Protection Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz)

#### Fact Sheets

- o Electromagnetic Interference & Medical Equipment
- o ELF and VLF Electric and Magnetic Field Emissions from VDT's
- Electromagnetic Interference of Video Display Units by Extremely Low Magnetic Fields
- o Radiofrequency Radiation from Cellular Phones

#### Laser Presentations

- o Hazard Alert for Pen-Like and Other Laser Pointers
- o Capabilities of Laser Optical Radiation Program
- Ultraviolet Radiation Protection, and the Science of UV Exposure from the Sun and Sky
- o The Laser/Optical Radiation Program: Professional Training and Services
- o Mercury Vapor and Metal Halide Lamps Used for Illumination
- Hazard Alert: Potential for Eye Injury from Medical Lasers Used in Dermatological Surgery
- o Powerpoint Laser Presentation

#### Regulations

- Federal Communications Commission Office of Engineering & Technology Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields
- o Army Regulation 385-10
- Canadian Environmental Health Directorate Safety Code 23, Guidelines for the Safe Use of Ultrasound Part 1: Medical and Paramedical Applications
- Canadian Environmental Health Directorate Safety Code 24, Guidelines for the Safe Use of Ultrasound Part 2: Industrial and Commercial Applications
- o Canadian Environmental Health Directorate Safety Code 25, Short-Wave Diathermy, Guidelines for Limiting Radiofrequency Exposure
- Canadian Environmental Health Directorate Safety Code 26, Guidelines to Exposure to Electromagnetic Fields from Magnetic Resonance Clinical Systems
- Canadian Environmental Health Directorate Safety Code 6, Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3kHz to 300 GHz
- Department of Defense Instruction 6055.11, Protection of DoD Personnel from Exposure to Radiofrequency Radiation and Military Exempt Lasers
- o New Jersey Regulations Nonionizing Radiation
- o Army Regulation 11-9, The Army Radiation Safety Program

#### Radiofrequency Radiation Presentations

- o Bioeffects
- o Calculations
- Command Briefing
- o Radiation Protection Program
- o Radiofrequency Systems
- o Radiofrequency Radiation Terms
- o Wireless Communication

#### Instruction Manual

o Radiofrequency and Ultrasound Course Manual 2000

#### • Sample Reports

o NASA Ames, RF Survey, 23 Feb 1992